A new mobile diagnostic platform is designed to speed up identification of the eleven most relevant periodontitis pathogens considerably. Scientists at the Fraunhofer Institute for Cell Therapy and Immunology IZI in Leipzig have collaborated with two companies, BECIT GmbH and ERT-Optik, to develop a lab-on-a-chip module called ParoChip. In future this will allow dentists and medical labs to prepare samples quickly and then analyse the bacteria. All the steps in the process - the duplication of DNA sequences and their detection - take place directly on the platform, which consists of a disk-shaped microfluidic card that is around six centimetres in diameter. “Until now, analysis took around four to six hours. With ParoChip it takes less than 30 minutes. This means it’s possible to analyse a large number of samples in a short amount of time,” says Dr. Dirk Kuhlmeier, a scientist at the IZI.

Samples are taken using sterile, toothpick-shaped paper points, after which the bacteria are removed from the point and their isolated DNA injected into reaction chambers containing dried reagents. There are eleven such chambers on each card, each featuring the reagent for one of the eleven periodontal pathogens. The total number of bacteria is determined in an additional chamber, via polymerase chain reaction (PCR). This method allows millions of copies of even tiny numbers of pathogen DNA sequences to be made.

In order to generate the extremely quick changes in temperature that are required for PCR, the disk-shaped plastic chip is attached to a metal heating block with three temperature zones and mechanically turned so it passes over these zones. This causes a fluorescent signal to be generated that is measured by a connected optical measuring device featuring a fluorescence probe, a photo detector and a laser diode. The signal makes it possible not only to quantify each type of bacterium and thus determine the severity of the inflammation, but also to establish the total number of all the bacteria combined.

According to an article published in the January/February 2013 issue of General Dentistry, the peer-reviewed clinical journal of the Academy of General Dentistry (AGD), obesity may be a risk factor for gum disease.

“We know that being overweight can affect many aspects of a person’s health,” says Charlene Krejci, DDS, MSD, lead author of the article. “Now researchers suspect a link exists between obesity and gum disease. Obese individuals’ bodies relentlessly produce cytokines, proteins with inflammatory properties. These cytokines may directly injure the gum tissues or reduce blood flow to the gum tissues, thus promoting the development of gum disease.”

Research on the relationship between obesity and gum disease is still on-going.

“What we do know is that it’s important to visit a dentist at least twice a year so he or she can evaluate your risks for developing gum disease and offer preventive strategies.”

The best way to minimise the risk of developing gum disease is to remove plaque through daily brushing, flossing, rinsing, and professional cleanings.

“A dentist can design a personalised program of home oral care to meet each patient’s specific needs,” says Dr. Shamoon.
Blackberries could prevent and treat gum disease

Research, the antibacterial properties of blackberry extract could help to prevent or aid in the treatment of gum disease, which, if left untreated, may result in tooth loss.

Natural extract from blackberries have previously been linked with blocking the spread of cancer cells, and showed the greatest total antioxidant capacity when measured against blueberry, raspberry, red currant, and both cultivated and wild strawberries.

Blackberries join a growing list of foods that could help prevent oral health problems. Strawberries and green vegetables have been linked to reducing the chance of developing oral cancer, while other studies have discovered fish and fish oil can fight gum disease.

Chief Executive of the British Dental Health Foundation, Dr Nigel Carter OBE, thinks the research highlights the importance of indulging in a healthy, balanced diet.

Dr Carter says: “Having a balanced diet rich in vitamins, minerals and fresh produce to provide anti-oxidants is something we should all be striving to achieve. It can help to prevent a number of oral health problems including gum disease and oral cancer, not to mention potential heart problems too.

“Although the study is promising, it is important to remember that any use of blackberries in preventing and treating gum disease should be as well as maintaining a good oral hygiene routine. Prevention is a really important word when it comes to oral health and it is fairly easy to keep on top of. It does not take up too much time or a lot of money, yet it is surprising how many people actually forego basic oral hygiene principles, including brushing for two minutes twice a day.”

Gingivitis bacteria manipulates immune system

A new research report published in the Journal of Virology shows how the bacteria known for causing gum disease, Porphyromonas gingivalis, manipulates the body’s immune system to disable normal processes that would otherwise destroy it.

Specifically, the report shows that this pathogen prompts the production of the anti-inflammatory molecule Interleukin-10 (IL-10). This, in turn, inhibits the function of T-cells, which would otherwise help to protect the host from this particular microbial infection.

To make this discovery, scientists used cells from mice that were exposed to P. gingivalis. One portion of these cells was treated with an inhibiting antibody against IL-10 and the other portion of cells was not treated. All of the cells were then tested for interferon gamma production. An increase of interferon gamma production was seen in the treated cells, but no increase was found in the untreated cells.

These findings suggest that the damage done by P. gingivalis happens when the immune cells of the host are first exposed to this pathogen, and further implies that for treatment to be successful, it must be started as early as possible.

This study highlights the mechanism by which P. gingivalis can establish a chronic infection in the form of periodontal disease and provides insight into how the disease develops.

Results also demonstrate the importance of very early intervention either by eradication of the bacterium with specifically designed therapeutics or by prevention via the development of an effective vaccine.

“Gum diseases and the infections that cause them can be incredibly stubborn and difficult to treat,” said John Wherry, Ph.D., Deputy Editor of the Journal of Leukocyte Biology. “What isn’t as well known is why these infections are so difficult to eradicate. These new studies now demonstrate that these bacteria go beyond merely evading our body’s defenses and actually manipulate our immune systems for their own survival.”

Gum disease may worsen AIDS

Scientists at the Texas Biomedical Research Institute have found that moderate gum disease in an animal model exposed to an AIDS-like virus had more viral variants causing infection and greater inflammation. Both of these features have potential negative implications in long term disease progression, including other kinds of infections, says the report published in the Journal of Virology.

The public health message from the study is that even mild inflammation in the mouth needs to be controlled because it can lead to more serious consequences, said Luis Giavedoni, first author of the study.

“After infection with the simian AIDS virus, the generalised acute inflammation induced by the virus was exacerbated in the animals with gingivitis, indicating that even mild localised inflammation can lead to a more severe systemic inflammation,” he said.

Giavedoni and his colleagues studied whether inflammation of the mouth would increase the susceptibility of the monkeys becoming infected with the monkey AIDS virus. This was based on epidemiological evidence that shows that infection and inflammation of the genital mucosa increases the chances of becoming infected with HIV by the sexual route.

The scientists induced moderate gum inflammation in a group of monkeys, while a second group without gum inflammation served as a control. After exposing both groups of macaques to infectious SIV, a monkey virus similar to AIDS, they did not observe differences in the rate of infection in the mouth, indicating that moderate gum disease did not increase the chances of getting infected with the AIDS virus.

“However, we did observe that the animals that had gum inflammation and got infected had more viral variants causing infection and they also showed augmented systemic inflammation after infection; both of these findings may negatively affect the progression of the viral infection.” Giavedoni said.

Study links periodontitis with diabetes

Long term data published in Diabetes Research and Clinical Practice has provided further scientific evidence that people with Type 2 diabetes mellitus (T2DM) have a great risk of periodontitis.

The researchers have sent over 50,000 males biennial questionnaires since 1988, and from their data found that “at baseline, men with T2DM were more likely to report hypertension, were missing more teeth, consumed less alcohol, and were less likely to be dentists than those without.”

Risk of periodontitis was found to be 59 per cent higher in men with T2DM than in men without. T2DM was also associated with a 22 per cent increased risk of tooth loss compared with those without.

“In this study with 20 years follow-up, T2DM was significantly associated with greater risk of self-reported periodontitis”, the study authors wrote.

“These results hold important public health implications due to the associations between periodontitis and cardiovascular disease and nutritional alterations associated with tooth loss. Greater collaboration between dentists and cardiologists could be used to identify at-risk patients in both clinical settings.”

T2DM is associated with a greater risk of periodontitis.
EuroPerio7 - A Sparkling Success!

Report by Peter Galgut

EuroPerio is a tri-annual conference in which everyone involved in periodontics in Europe and farther afield gathers together to learn and see what’s new and what is up and coming in periodontics. This year the 7th conference was held in the beautiful old city of Vienna, with all its lovely restaurants and coffee houses, beautiful buildings, galleries, palaces and lovely congenial atmosphere.

Dentists, hygienists, periodontists in clinical practice, teachers, professors, and research workers in periodontics gather together to share their knowledge and experience and learn from each other. The social programme brings people together in a formal way so that old friends can catch up with each other and renew old friendships. However most of the socialising goes on in the many cafes and corridors in and around the conference centre.

The programme is so extensive that many lectures go on concurrently and it is often difficult to choose which one to go to as there is always something of interest to the clinician as well as researchers’ students, hygienists and general dental practitioners.

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The trade show usually has over 100 participants showcasing the newest and the best products in preventive and periodontal care available in Europe with some companies also from the United States and elsewhere.

The 2012 conference featured lectures on implantology, highlighting new implants, and new techniques for not only placing implants, but maintaining them as well. Several companies had innovative systems for sinus lift procedures and placing graft material into the sinus cavity utilizing minimal surgical intervention techniques.

Other lectures covered new concepts in periodontal disease management, preventive care. So, this is not just a conference for periodontists but there is something for everyone who is interested in preventive and periodontal care.

What is really exciting is that the next EuroPerio (8) conference is going to be held right here in London. The organising committee of the British Society of Perio is working hard at putting this major international conference together, and it is a great opportunity to showcase the best in British dentistry to Europe. The conference is scheduled to take place in the Excel Centre on 5-6 June 2015, so please put the date in your diary, and register for the conference as soon as the bookings open.

Even better, why not join the British Society of Periodontics in advance (Phone Helen Clough: 0844 3551915, or visit the website www.bsperio.org.uk) and make sure that not only do you keep your preventive care programme and your periodontal treatment strategies up-to-date, but also that you are first in the queue when bookings open in 2015.

### About the author

Dr Peter Galgut qualified as a dentist in 1971, and gained a MSc with distinction in Periodonitics in 1983. Subsequently he obtained the MRD (Membership of Restorative Dentistry) and also the MFGDP from the Royal College of Surgeons of England. He was awarded a MPhil in acknowledgement of his research in biomaterials and wound healing. In addition, he has a Diploma of Dental Homoeopathy awarded by the Faculty of Homoeopathy at the Royal National Homoeopathic Hospital, London. He is well published and he has worked as a Senior Research Fellow at the Eastman Dental Institute, researching dental calculus and subjects related to preventive dental care. He has published over 120 papers arising from his work.
**Perio-endo lesion: Dilemma unfolded**

Dr Naylah Fajandar, MOs, Dr Sneha R. Gokhale-Gaikwad, MDS, Dr Sameer Jadhav, MDS, Dr Vivek Hegde, MDS

Scientific advances have segmented the field of dentistry into a vast number of specialisations. Each specialised clinician performs a specific task. However, there are instances where treatment from single specialist will not eradicate the disease, the reason being the intricate nature of tooth, with its surrounding environment. In such cases it then becomes mandatory to adopt an interdisciplinary approach among professionals for complete rehabilitation. An interdisciplinary approach is most commonly required in cases of an Endodontic-Periodontic lesion.

The relationship between periodontal and pulpal disease was first described by Simon and Goldberg in 1964. Since then the term ‘Perio-Endo’ lesion has been used to describe these lesions. Perio-endo lesions arise from inflammation or degeneration of both pulp and periodontal tissues as a result of an intimate embryonic, anatomic and functional interrelationship between them.

The various pathways of communication between the pulp and the periodontium may be classified as follows:

I) Developmental pathways include the apical foramen, root canals, developmental or lingual grooves

II) Pathological pathways include empty spaces created by destroyed Sharpey’s fibers, root fractures following trauma, idiopathic resorption (internal or external) and cemental agenesis or hypoplasia.

III) Iatrogenic pathways include exposure of dental tubules following root planning and accidental lateral perforations during endodontic treatment.

Endodontic-periodontic diseases can be classified into:

A. Primary endodontic disease: A chronic apical abscess may drain coronally through the periapical ligament into the gingival sulcus. This condition may mimic clinically the presence of a periodontal abscess. Primary endodontic lesions usually heal following root canal treatment.

B. Primary periodontal disease: These lesions are caused primarily by periodontal pathogens. In this process, chronic periodontitis progresses apically along the root surface. In most cases, pulp tests indicate a clinically normal pulp reaction.

C. Combined lesions: Primary periodontal disease with secondary periodontal involvement:

If after a period of time a suppurating primary endodontic disease remains untreated, it may become secondarily involved with periodontal breakdown. The tooth now requires both endodontic and periodontal treatments. If the endodontic treatment is adequate, the prognosis depends on the severity of the periodontitis and the efficacy of periodontal treatment. With endodontic treatment alone, only part of the lesion will heal to the level of the secondary periodontal lesion.

Primary periodontal disease with secondary endodontic involvement:

The apical progression of a periapical pocket may continue until the apical tissues are involved. In this case the pulp may become necrotic as a result of infection entering via lateral canals or the apical foramen.

True combined disease: True combined endodontic-periodontal disease occurs less frequently than other endodontic-periodontal problems. It is formed when an endodontic disease progressing coronally joins with an infected periodontal pocket progressing apically. In most cases periapical healing may be anticipated following successful endodontic treatment.

This case report describes a case with most common symptoms of pain and swelling.

Case Report:

A 55-year-old male patient reported to the Department of Periodontics, M.A. Rangoonwala Dental College and Research Center, Pune with the complaint of pain, swelling and pus discharge from the mandibular right posterior region for four to five days. The tooth pain was moderately throbbing in nature and aggravated on mastication. The patient first noticed a small swelling in the gingiva which increased in size over three to four days. The dental and medical history was non-contributory.

On clinical examination the patient presented a small swelling in relation to mandibular right first molar. No caries or restoration was present. There was no evidence of vertical or horizontal...
fracture. The gingiva in relation to the involved tooth appeared soft and oedematous whereas the generalised consistency of the gingiva was firm and resilient (Fig 1). Bleeding on probing was also present in the same area. Periodontal probing depths were measured at 10mm mesially, 5mm buccally and lingually 5mm. The tooth showed grade I mobility and grade II furcation involvement. The patient experienced pain on vertical percussion. A periapical radiograph showed widening of the periodontal ligament space, radiolucency in the furcation area and differential bone loss along the mesial root (Fig 2). Electric pulp vitality test resulted in response, thus indicating of a vital pulp. A periodontal abscess associated with mandibular right first molar was diagnosed. The lesion was diagnosed to be of primary periodontal origin with secondary endodontic involvement.

Emergency Treatment:
The abscess was drained through the pocket and a thorough irrigation with Betadine was performed. Antibiotics were not prescribed as the patient was afebrile and there was no evidence of regional lymphadenopathy.

Phase I therapy: The patient was recalled for scaling and root planning after four days. Patient continued to complain of mild pain though the swelling had reduced. After evaluation of the Phase I therapy, endodontic therapy was initiated.

Definitive treatment: An access cavity was prepared and the root canal system was cleaned and shaped during the first session using Protaper (Dentsply) along with copious irrigation with 5.25 per cent sodium hypochlorite and saline. The patient returned after one week and the endodontic treatment was completed using six per cent gutta percha and AH Plus sealer (Dentsply Maillefer). Post endodontic restoration was done with silver amalgam. (Fig 3)

After the endodontic treatment, the patient was asymptomatic and the gingiva appeared healthy. However, the pocket probing depths were still nine and five mm mesially and buccally respectively. Access flap surgery was performed to eliminate the pocket. After flap reflection, debridement of the defect and irrigation was performed using hand curettes (Hu FreydY) and ultrasonic instrumentation (Figure 4). The intrabony defect was a combination of two and three wall defect. Two wall defect in the coronal portion of the mesial root and three wall defect apically (Fig 5). Freeze dried bone allograft (FDBA) was placed in the furcation as well in the intrabony defect (Fig 6). The flaps were approximated with the help of 5.0 black braided silk suture (Sterisil®). The graft material was completely covered and the flap was closely adapted to the tooth. Periodontal dressing was placed. Amoxicillin 500mg tid was prescribed for five days to assure minimal infection during healing phase. Immediate post operative radiograph was taken which shows evidence of graft material in the defect and the furcation area (Fig 7). Patient was recalled after a week for removal of sutures.

Patient was recalled at regular intervals for maintenance program and oral hygiene instructions were reinforced. There was no evidence of antigenic response to the graft. Radiographs were taken at the intervals of six months and one year. The radiographic picture clearly shows bone fill in the furcation and intrabony defect after one year (Fig 8). Thus the tooth was successfully treated by endodontic and periodontal interventions with satisfactory results.

Discussion:
In periodontitis, a periodontal abscess represents a period of active bone destruction (exacerbation), although such events also occur without abscess formation. The existence of tortuous pocket may favour the formation of abscesses (Carranza 1990). The marginal closure of the periodontal pocket, may lead to an extension of the infection into the surrounding periodontal tissues due to the pressure of the suppuration inside the closed pocket (Kareha et al 1981, Newman and Sims 1979). Changes in the composition of the microflora, bacterial virulence, or in host defences could also make the pocket lumen inefficient to drain the increased suppuration.

In this case, periodontal abscess was a result of Chronic Periodontitis with secondary endodontic involvement. It has been suggested that intrapulpal infection tends to promote marginal epithelial down growth along a denuded dentin surface (Blomlof et al.1992). Additionally, experimentally induced periapical defects in infected teeth were associated with 20 per cent more epithelial down growth than non-infected teeth. Non-infected teeth showed 10 per cent more connective tissue coverage than infected teeth (Janson et al 1995). Hence, the endodontic therapy was performed before a definitive periodontal therapy.

Periodontal surgical procedures result in a harmonious anatomical relationship between the tooth and gingiva as well as correction of any underlying osseous defects which leads to positive correlation between the contour of the gingiva and the topography of the underlying alveolar bone. Persisting osseous irregularities may result in residual deep sulci or pockets making a sustainable level of acceptable plaque control more difficult, thus increasing the chances of further periodontal breakdown.

Kareha et al (1981), local factors affecting the morphology of the root. The presence of external root resorption (Yusof and Ghazzali 1989), an invaginated tooth (Chen et al 1990), or a cracked tooth (Goose 1981) have also been suggested as predisposing factors for periodontal abscess formation.

Periodontitis is a chronic immune-inflammatory disease caused due to infection by specific micro-organisms. A chronic lesion consists of macrophages, plasma cells, granulation tissue and destructed collagen fibres. An acute inflammatory response results in dynamic healing response to appropriate therapy.
and is more favourable for achieving new attachment.

Therefore periodontal flap surgery along with bone graft placement is done to a more predictable outcome in this case. Trombelli et al. (2002), in his systematic review stated that use of biomaterials/ pathological along with open flap debridement was more effective in improving attachment levels in intra-osseous defects. The morphology of the defect is an important factor that determines the outcome of the regenerative therapy. In this case, there was a combined two to three wall defect and a grade II furcation involvement which provides most predictive outcome of grafting procedures. The management of grade II furcation involvement presents a unique clinical problem. Reasons for compromised results in furcation areas include the lack of proper access for instrumentation as well as for proper maintenance care due to the complex furcation anatomy and consequently a persistence of pathogenic microflora.

The recent systematic review by Scalean et al. (2008) provides histological evidence of periodontal regeneration with the use of grafts and barrier membranes in combination. However, the combination of grafts and barrier membrane did not provide additional advantage in Grade II furcation and three wall defects. The space providing properties of the graft material proved to be useful in periodontal regeneration. In this case, barrier membrane was not used as the tissues were fragile and there was a risk of membrane exposure. However, satisfactory results have been obtained with FDBA as a bone graft material.

Mineralised freeze dried bone allograft (FDBA) has osteo-conductive properties thus acts as a scaffold for bone formation. Extensive research has been done on FDBA as a graft material. Mellonig in 1991 found that at least 50 per cent bone fill in 67 per cent of periodontal defects and the percentage increased to 78 per cent if it was combined with autograft.

In the present case, the lesion was primarily of periodontal origin with secondary endodontic involvement. Therefore, the success of the treatment depended on the periodontal treatment. Satisfactory results were obtained after access flap surgery along with the use of FDBA.

Conclusion:
The endo-perio lesions have always been a diagnostic and prognostic dilemma. The treatment plan also varies depending upon the type of lesion. Primary endodontic and periodontal lesions heal completely by endodontic and periodontal therapy respectively. However, combined lesion often requires both endodontic and periodontal therapy. Proper diagnosis, decision making and treatment plan can change the prognosis of such cases from hopeless to hopeful.

References:
According to Government statistics, there are 10 million people in the UK who are over 65 years old and this figure is anticipated to almost double by 2050. Added to this, life expectancy continues to increase; a baby born nowadays might expect to live to 91 or 92 years of age. However, healthy life expectancy is not keeping up with our ageing population, the Government claims, because of older residents’ proportionally greater demands on public services.

These demographic trends highlight the need for dental professionals to focus their attention on the maintenance or improvement of our older generations’ oral health. For elderly patients, ageing itself is an additional factor contributing towards poor oral health, as is systemic disease, weakened immunity and infirmity; the latter of which may contribute towards an inadequate oral hygiene routine.

Oral and dental disorders have a particularly significant impact on patients who are more advanced in years. Whether they are denture wearers, have partial tooth loss or still retain all of their own teeth, for the elderly, a healthy mouth is crucial to their quality of life. With few other distractions, the ability to communicate for social acceptance and interaction, along with enjoyment of food are essential to achieve psychological wellbeing. And of course being able to eat a variety of meals and ingredients increases the likelihood of taking in the right nutrients for optimum overall health.

A lack of oral hygiene, leading to infection, disease and/or pain, has severe repercussions in terms of an older individual’s confidence, dignity and nutritional needs. Unsightly inflammation, bleeding, missing teeth, or sores leading to ill-fitting dentures will knock self-esteem and encourage avoidance of others to prevent risk of embarrassment. But this self-imposed isolation brings a great deal of unhappiness in itself. Evidence also suggests a connection between substandard oral health and serious disorders such as pneumonia in older patients, with those who are hospitalised or in care homes made especially vulnerable.

In addition, older patients are at high risk of suffering from xerostomia, or dry mouth, which seriously enhances the risk of dental disease. As the population ages, they are increasingly likely to be receiving prescription drugs for age-related conditions and, unfortunately, dry
mouth is a common side effect for the majority of these medicines. Patients who lack adequate saliva production are more likely to develop infections in the mouth, scars and have difficulty in eating and speaking — again, having a negative effect on social interaction and nutritional intake.

Healthcare providers can help their elderly patients by asking about their daily oral care habits and recommending hygiene methods to suit their lifestyle. Brushing twice a day with a fluoride toothpaste supported by interdental cleaning may be the mantra of the day, however older patients may lack the necessary dexterity to operate products such as dental floss. By adding an antiseptic mouthwash to their daily oral care, on the other hand, most patients can easily clear more food debris and reduce bacteria in the mouth, helping to prevent gum disease and caries.

However not all mouthwashes are the same. Many still contain alcohol as a key ingredient, which can irritate oral tissues and cause a dry mouth — clearly an unsuitable ingredient, which can irritate mucosa and dentures; and this must be encouraged amongst our older patients to ensure their remaining years arecontented ones. Whether by infirmity or illness, elderly people require more user-friendly oral hygiene products and there is no doubt that mouthwash is straightforward for most individuals to use and, if it is a CHX-based solution, offers considerable protection and guarantees results.

### About the author

Following his degree in biochemistry, Howard’s early career was in the pharmaceutical industry, where he worked for a number of the large multinationals before becoming CEO of Mevex for 11 years. After leaving Mevex, Howard set up his own company Britannia Health Products, Britannia Health Products developed and launched the world’s first Evening Primrose Oil product (Efamol), which became market leader and reputedly introduced the market for health supplements. Subsequently, Howard introduced Isomor, a natural product for preventing wrinkles and damage to the skin caused by free radicals and ultra violet light which received tremendous press coverage as a breakthrough in the prevention of premature skin ageing when it was launched. Since 1980, Howard has worked with many research groups developing ‘natural remedies’ and has been involved with many health-related organisations. He set up his own nutritional supplement company for the human and veterinary markets and also has been director of a number of biotechnology start-up companies in the Cambridge area. Until recently, his principle activity was as Chairman of LIFE Plus Europe, a successful multi-level marketing company supplying nutritional products on a personal support basis throughout Europe. In January 2001, he sold that business to the US affiliate and is now taking a much more active role in the management and group development of Oralite Ltd. Howard is focusing on developing a range of natural products for the dental market. The dental market in terms of product development has been neglected by companies, yet over 90% of the population has some form of gum disease and suffer from minor to severe discomfort.
Probiotics: Bactiotherapy for oral health

Dr. Rahul Kale, MDS, Dr. Sonal Tambwekar, MDS, Dr. Sumanth, MDS, Dr. A. Sanjay Jain, MDS, Dr. Sharmila Baliga, BDS

Probiotics literally means "for life". They are microorganisms proven to exert health-promoting influences in humans and animals. Probiotics are defined by the World Health Organisation as "live microorganisms which when administered in adequate amounts confer a health benefit on the host". A recent detailed definition of probiotics is "a preparation of a product containing viable, defined microorganisms in sufficient numbers to alter the existing microorganisms in the intestine of the host and thereby exert beneficial health effects". These bacteria have to be the natural flora so as to be able to resist acid and bile, to survive during intestinal transit, to adhere to the intestinal mucosa, and to produce antimicrobial substances in order to retain the characteristics that contribute to their beneficial health effects.

Probiotics must have the ability to inhibit gut pathogens, and they have to be stable during manufacture and storage which can influence both viability and functional properties. A number of bacterial strains have been isolated. However, all do not have the same efficacy. It is important that the potential probiotic strains are well selected prior to use. A combination of strains can enhance adherence in a synergistic manner.

Increase in antibiotic resistant infections due to overuse of antibiotics by physicians has prompted the need to seek safer ways to treat infections.

Recent scientific investigation has supported the important role of probiotics as a part of a healthy diet for human as well as for animals and may be an avenue to provide a safe cost effective and natural approach that adds a barrier against microbial infection. The use of probiotics in antibiotic resistance is termed as a microbial interference therapy. This concept of microbial ecological change as a mechanism for preventing dental change is an important one since oral infections constitute most common forms of infections in humans. Evidence is now accumulating that probiotics may also play a role in oral ecology. Researchers believe that the probiotics are beneficial for oral health in prevention and treatment of various dental diseases.

In 1967, Elie Metchnikoff, a Nobel prize winning Russian microbiologist, first proposed a hypothesis where he suggested that the long, healthy life of Bulgarian peasants resulted from their consumption of fermented milk products. He believed that when the intestinal bacteria Lactobacillus positively influenced the microflora of the colon, decreasing toxic microbial activities within.

In the 1950s, a probiotic product was licensed by the United States Department of Agriculture as a drug for the treatment of scour among pigs.

The term probiotics which is an antonym to the term antibiotics, was introduced in 1965 by Lalley and Stibbwell as "substances produced by microorganisms which promote the growth of other microorganisms".

Mann and Sproeir in 1974 found that people who drank yogurt fermented with strains of Lactobacillus sp. had very low values of blood serum cholesterol.

The first probiotic species introduced into research were Lactobacillus acidophilus by Hull et al in 1984 and Bifidobacterium bifidum by Holcomb et al in 1991 (Tandboga et al 2005).

In 1994, the WHO deemed probiotics to be the next most important immune defence system when commonly prescribed antibiotics are rendered useless by antibiotic resistance. (Kalaasapathy and Chin 2000; Levy 2000).

Over the last century, various microorganisms have been used to prevent and cure diseases leading to the coining of the term probiotics.

Nobel prize winning Russian microbiologist, first proposed a hypothesis where he suggested that the long, healthy life of Bulgarian peasants resulted from their consumption of fermented milk products. He believed that when the intestinal bacteria Lactobacillus positively influenced the microflora of the colon, decreasing toxic microbial activities within.

Researchers have shown that the probiotics have bio-therapeutic potential for prophylaxis against the candidiasis. The probiotic bacteria can protect individuals from candidiasis by immunological and non immunological mechanisms.

Probiotics can activate and modulate the immune system. They reinforce the gut defence by immune exclusion, immune elimination and immune regulation.

Effects of probiotics on oral health:

Since the mouth represents the first part of the gastrointestinal tract, there is every reason to believe that at least some probiotic mechanisms may also play a role in that part of the system. Mechanisms of probiotics are drawn entirely from GIT studies; their applicability to oral health needs further study. It may also anticipate that resident probiotics could exist in the oral microflora. They may function in the complex ecosystem of dental plaque and in formation and development of oral biofilms in general.

Some hypothetical mechanisms of action of probiotics in the oral cavity are discussed here. Probiotics may act by direct or indirect interaction on oral biofilm and microflora and vice versa.

Direct interactions may include:

1. Involvement in binding of oral microorganisms to proteins (biofilm formation).
2. Action on plaque formation and on its complex ecosystem by compromising and intervening with bacteria to bacteria attachments.
3. Involvement in metabolism of substrate (competing with oral microorganisms of substrates available).
4. Production of chemicals that inhibit oral bacteria (antimicroorganisms).

## Table: Role of Probiotics in Oral Health

<table>
<thead>
<tr>
<th>Role</th>
<th>Outcome</th>
<th>Strains</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plaque control and gingival inflammation</td>
<td>Reduction in plaque accumulation and gingivitis.</td>
<td>Nisin, bacteriocin extracted from L. lactis</td>
<td>K. Noordin and S. Kamamà.</td>
</tr>
<tr>
<td>Periodontitis in smokers</td>
<td>Improvement of plaque index and probing pocket depth from baseline within 8 weeks</td>
<td>L. salivarius WB21</td>
<td>H. Shimauchi et al 2008</td>
</tr>
<tr>
<td>Reduction of malodor</td>
<td>In vivo and in vitro study showed a definite inhibitory effect on production of VSC.</td>
<td>W. cibaria</td>
<td>Kang et al 2006.16</td>
</tr>
<tr>
<td>Reduction of malodor</td>
<td>Prevents re-establishment of undesirable bacterial populations and thus help limit the recurrence of oral malodor after a prolonged period</td>
<td>Streptococcus salivarius</td>
<td>Burton JP et al, 2005.17</td>
</tr>
<tr>
<td>Attachment, adhesion and oral colonisation</td>
<td>Co-aggregated with F. nucleatum like Bacteroides sp. Actinomyces sp. and C. albicans</td>
<td>W. cibaria</td>
<td>Kang et al, 2005.15</td>
</tr>
<tr>
<td>Periodontal diseases</td>
<td>Peri-eratal dressings with lactobacillus species diminish the number of periodontal pathogens like Bacteroides sp. Actinomyces sp. and C. albicans</td>
<td>Lactobacillus species</td>
<td>Volozin et al 2004.17</td>
</tr>
<tr>
<td>Periodontal diseases</td>
<td>Inhibits the growth of P. gingivalis and P. intermedia</td>
<td>Resident lactobacilli flora</td>
<td>Kolf-Klaas et al 2006.20</td>
</tr>
<tr>
<td>Yeast infections</td>
<td>Rapid decline in C. albicans in mice with a correlation between the highest peak of interleukin-4 and complete eradication of C. albicans</td>
<td>L. acidophilus and L. fermentum.</td>
<td>Elalou et al 2005.21</td>
</tr>
<tr>
<td>Dental caries</td>
<td>Significant reduction in the counts of S. mutans after 2 weeks</td>
<td>L. reuteri</td>
<td>Caglar et al 2006.6</td>
</tr>
<tr>
<td>Root canals</td>
<td>Effective at eradicating E. faecalis and S. gordonii within root canal.</td>
<td>Nisin, bacteriocin extracted from L. lactis</td>
<td>Turner et al 2004.34</td>
</tr>
</tbody>
</table>

## Figure: Proportion of Mechanisms of Action

1. Involvement in binding of oral microorganisms to proteins (biofilm formation).
2. Action on plaque formation and on its complex ecosystem by compromising and intervening with bacteria to bacteria attachments.
3. Involvement in metabolism of substrate (competing with oral microorganisms of substrates available).
4. Production of chemicals that inhibit oral bacteria (antimicrobial).
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- Virofex is highly effective against bacteria, fungi, TRIs, viruses and spores; including MRSA, C-Diff, HIV, Hepatitis and Rotavirus.
- Tests have shown that, even after 24 hours, surfaces sprayed with Virofex have a high resistance to contaminating organisms.
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References: